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EDITORIAL

On these pages the editor offers his opinions, unshackled by advertising patrons and unrestrained by anything save a sense of the decent and the truthful. The editor, alone, is responsible for their type, their tone and their tenor.

IN THE INTEREST OF PHARMACY

FUNDAMENTALLY pharmacy is a profession serving the cause of public health. The Commonwealth of Pennsylvania and the States of the Union so recognize it, and the profession itself, keen to measure up to its responsibilities and its obligations, has through specific education in the technical fields as well as with a sound training in the cultural subjects, groomed itself so that its practitioners today are worthy of their hire and capable custodians of an important trust.

Education in pharmacy in this age is on a high level, and the Commonwealth, with legal agencies largely designed by the profession itself, insists that certain phases of dealing in drugs shall be done only by college graduates in pharmacy, bachelors of science, receiving their degrees in recognized institutions of learning. These institutions, as exemplified by four leading such schools in Pennsylvania, the University of Pittsburgh, Duquesne University, Temple University, and last but not least, the Philadelphia College of Pharmacy and Science, the oldest institution of its kind in the New World, are second to no professional schools in the range of their facilities, in the qualifications of their faculties, and in the character of their curricula. In these institutions men and women are trained for the supervision of retail pharmacies, for compounding prescriptions and dispensing other agencies of therapy, as hospital pharmacists, as pharmacists in the Service of the Army and the Navy, and manufacturing pharmacists. It is unfortunate however that because of certain tinselled and unimportant externals many persons have a wrong conception of the broad scope and service of pharmacy in the interest of public health, and particularly so of the services of the retail pharmacy. Yet it is a fact that the man who prepares the medicament is as necessary to the picture as the man who prescribes

Note: This is part of a brief presented to a Legislative Committee of the Commonwealth of Pennsylvania, in connection with new bills affecting the practice of pharmacy.

it. His sense of obligation to a code of honor and his responsibility to society are in no wise less than those of the physician. The pharmacist who compounds his medicines with care and skill and honesty, remembering that every ingredient, no matter how humble its medicinal mission, was designed for a sick human being, is a real servant of society. Pharmacy, with its fine background of contributions to the healing art, is serving creditably in spite of handicaps, and continue to serve it will, so long as the hand of pain rests heavily on the hearts of little children, so long as the nightmare of agony surrounds the birth-bed, so long as strong men shudder in the cruel grasp of disease, and so long as man is urged to practical sympathy for those loss fortunate than himself.

However, through a strange paradox, partly due to public apathy, partly due to odd practices within the profession itself, but more largely because of organized opposition, founded mostly on selfish interest, the public does not receive the full benefit of these trained specialists. In other fields where such opposition is not allowed to interfere the trained pharmacist is permitted to exercise his special training. Thus, in recent years, the departments of the Navy and the Army of our country have recognized firstly the need, and secondly the value, of men trained specifically in the compounding and dispensing of drugs, poisons and deleterious substances, and pharmacists are now commissioned officers in the service.

The American College of Surgeons, the national body which exercises jurisdiction over all hospitals, has made it mandatory for every accepted hospital to have upon its staff one or more trained pharmacists. Obviously, such developments are a definite outcome of advances in pharmaceutical education and a frank recognition of the value of pharmaceutical service. And yet in this Commonwealth, unless legislation of the right character becomes effective, our citizens are not afforded the protection that comes from proper pharmaceutical supervision. In the Commonwealth of Pennsylvania it is still possible for a plumber to plumb beyond his union card and turn to the making of medicines. There is no law to stop him. It is still a temptation and a legal possibility in this State for a bartender to concoct and sell a medicinal cocktail a thousand times more powerful than even the usual barroom cocktail. In this State anyone may make a patent and potent medicine, and there is no law to stop it. It is possible in this Commonwealth for a child to purchase in the

hardware shop or at the florists', and as easily as she might buy ribbon at the counter, vials of poison toxic enough in content to wipe out entire communities. Consider the current calamity in Philadelphia, where it is now believed that hundreds have gone to an early death at the hands of inspired poisoners, inspired by policy, insurance policy. The fact of the matter is that we have no law at present in Pennsylvania to stop such things.

The dispensing of poisons and the manufacture of medicinals are matters of significant and solemn importance in any community, and I repeat that it is a sad commentary upon the intelligence of the Commonwealth that these things which concern themselves with life and death should be so lightly regarded. It is not just the pharmacists of the Commonwealth that ask for this type of legislation and a chance and right to serve. The physicians of the State, the trained nurses, the large responsible dealers in drugs, the great manufacturing pharmaceutical concerns, have all expressed their opinions that the manufacture and dispensing of medicines and poisons be restricted to responsible hands. Indeed every thinking citizen within the confines of the State subscribes to such a program. Only those unwilling enough or unwitting enough to conform create and foster the opposition.

IVOR GRIFFITH

ORIGINAL ARTICLES

A SURVEY OF THE VISCOSITIES OF MEDICINAL MINERAL OILS

By Joseph F. McDonnell, Jr. and Philip M. Fairlamb

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THE U. S. P. XI monograph on Liquid Petrolatum, as did the U. S. P. X, distinguishes in its viscosity requirements between light and heavy Liquid Petrolatum. The heavy variety must have a kinematic viscosity of not less than 0.381 at 37.8 degrees C. (Saybolt 175 at 100 degrees F.) and the light variety must have a kinematic viscosity of not more than 0.370 at 37.8 degrees C. (Saybolt 170 at 100 degrees F.). The U. S. P. XI does not recognize as official an oil with a kinematic viscosity between 0.370 and 0.381 (170 and 175 Saybolt).

It is generally recognized, and specifically stated by Arny (1), that for laxative purposes a heavy oil possessing considerable viscosity is required. The present U. S. P. makes no requirement as to which viscosity is to be supplied for laxative purposes and most of the oil on the retail market at the present time is sold under the generic term "Mineral Oil."

In an attempt to clarify this situation and to set up significant viscosity standards which also reflect current commercial practice, this survey was undertaken.

Experimental—

Sixty-seven samples of Mineral Oil were secured at random throughout the Commonwealth of Pennsylvania from all types of vendors. The viscosity of each sample was determined at 100 degrees F. in a Saybolt Universal Viscosimeter according to the standard method (2, 3). The viscosimeter was standardized by comparison with Standard Viscosity Sample No. 3A furnished by the United States Bureau of Standards. Results are expressed in Saybolt seconds but viscosities under 350 Saybolt may be converted to kinematic viscosity, according to the U. S. P. (4).

Sample No.	Saybolt Viscosity at 100° F.	Sample No.	Saybolt Viscosity at 100° F.
971	359.8	1005	145.3
972	346.5	1006	342.9
973	327.6	1007	345.7
974	88.2	1008	87.4
975	85.7	1009	91.8
976	87.6	1010	77.3
977	83.0	1011	88.4
978	80.0	1012	91.4
979	137.9	1013	356.8
980	342.5	1014	207.4
981	345.9	1015	87.7
982	355.1	1016	76.2
983	185.3	1017	174.3
984	345.7	1018	71.3
985	356.3	1019	349.3
986	337.9	1020	349.5
987	85.2	1021	346.5
988	86.6	1022	340.0
989	163.1	1023	338.8
990	360.3	1024	86.7
991	90.4	1025	354.1
992	187.9	1026	345.5
993	365.7	1027	357.1
994	88.0	1028	89.4
995	329.3	1029	330.5
996	87.4	1030	338.5
997	167.4	1031	113.6
998	(not mineral oil sample)	1032	92.6
999	185.1	1033	348.8
1000	340.5	1034	220.7
1001	364.5	1035	89.0
1002	86.5	1036	79.5
1003	343.7	1037	90.4
1004	83.5	1038	80.5

The minimum viscosity found was 71.3 Saybolt seconds.
The maximum viscosity found was 365.7 Saybolt seconds.

General Viscosity Distribution of Samples

Less than 170 (Light, U. S. P.)	32
Between 170 and 175 (*non-official*)	1
More than 175 (Heavy, U. S. P.)	34
Total	67

Light Oils (less than 170 viscosity)

Less than 95 viscosity	27
95 to 170 viscosity	5
	32

Heavy Oils (more than 175 viscosity)

175 to 325 viscosity	5
More than 325 viscosity	29
	34

It is thus apparent that 84 per cent. of the light oils have viscosities of less than 95 Saybolt, and 85 per cent. of the heavy oils have viscosities of more than 325 Saybolt, with a scattering of the remainder at intermediate viscosities.

Average Viscosities

Group: less than 95 viscosity, average of twenty-seven samples, 85.6 Saybolt.

Group: more than 325 viscosity, average of twenty-nine samples, 347.0 Saybolt.

Discussion

A representative sampling of mineral oil sold at the present time in Pennsylvania for laxative purposes discloses the fact that about half is a light oil of approximately 85 viscosity and about half is a heavy oil of approximately 347 viscosity. Under the general term "Mineral Oil" either viscosity oil is being supplied.

It is recommended that the viscosity requirements of the U. S. P. XI for light and heavy Liquid Petrolatum be deleted and the following standard included in its place:

"Light Liquid Petrolatum shall have a viscosity of not less than 75 and not more than 95 Saybolt seconds at 100 degrees F., or a kinematic viscosity of not less than 0.1435 and not more than 0.1935 at 37.8 degrees C.

Heavy Liquid Petrolatum shall have a viscosity of not less than 335 and not more than 360 Saybolt seconds at 100 degrees F., or a kinematic viscosity of not less than 0.7355 and not more than 0.790 at 37.8 degrees C.

When Mineral Oil is requested without specification as to viscosity, the Heavy Liquid Petrolatum is to be supplied."

REFERENCES

1. Arny, H. V., and Fischelis, R. P.: Principles of Pharmacy (4th ed., 1937), 643.

2. U. S. P. XI, 476.

3. Federal Standard Stock Catalog Specifications, VV-L-791a, October 2, 1934, 17-22.

4. U. S. P. XI, 477.

WHAT IS A "COLD"—AND THEN WHAT?

By T. Swann Harding
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LEARNED anthropologists inform us that in Uganda it is customary to call a king's ailment a severe cold—senyiga—regardless of its real nature. Among us so-called civilized beings the time of the year is bound to roll around when colds are in full flower, and cold cures so abound, one is constrained to think that almost anything can be a cold—coryza or rhinitis, as doctors have it.

Boswell in his Life of Johnson says that Kenneth Macauley was advised to leave out of his History of St. Kilda "that wonderful story that upon the approach of a stranger all the inhabitants catch cold; but that it had been so well authenticated he determined to retain it." St. Kilda is an island of the outer Hebrides off Scotland.

Modern wise men tell us that St. Kilda is so situated as to render a northeast wind indispensable before a stranger can land; hence the wind not the stranger occasions the cold epidemic. More modern wise men still would say that the northeaster probably had nothing to do with the matter and that no one knows what causes or cures a cold.

Whenever an epidemic of colds or influenza appears in the United States those who consult physicians get a rather wide variety of prescriptions cast in terms of the therapeutic superstitions of the time. Once in a waggish mood the American Druggist investigated and summarized the widely differing prescriptions written and compounded during one epidemic and the results were enough to make doctors blush and run for cover. They at least indicated that science knew no true drug remedy for colds.

Two or three years ago an English doctor wrote to one of the British medical journals describing his infallible cure for all colds. He merely soaked his elbows for one-half hour in water as hot as they could bear and away went his cold. He did not explain how he kept the water almost unbearably hot without removing his elbows from the container for the period mentioned.

Obviously doctors have theories about colds. Colds offer a seductive opportunity for therapeutic speculation. For instance in 1932 the director of oto-laryngology at a New York hospital divided

all colds into two parts: Toxic and infectious; chemical and bacterial.

The former included all inflammations of the upper air tract caused by toxins flooding the blood stream from tonsils and tongue. The toxins set up "alkalosis" or allergic states and caused colds. The latter class included colds due to germs, difficult to cure, and in which local applications are ineffective.

In 1933 a German doctor told all about grippe, as he saw it. He recognized a real grippe and a sort of pseudogrippe that mimicked the real disease so that even experts were fooled. He talked learnedly of bacteria and filtrable viruses. Possibly the latter sensitized the body for a successful attack by the former. But just what germs were involved he did not know and he trailed off in a bacteriological fog.

At that he was probably as near the solution as any one so far. The august Journal of the American Medical Association periodically discusses the cause and cure ("etiology and therapy" if that sounds better) of colds as a sort of religious duty. The editorial in 1929 panned those who were manufacturing and advertising cold cures and piously suggested that nothing was better than a big double bed and a dozen handkerchiefs.

It then went on to remark that certain animals' diseases like distemper in dogs, snuffles in rabbits, and a respiratory infection in apes, resembled colds in human beings. But a study of the "bacterial flora" (bugs to us) in the mouth and upper respiratory tract, while productive of germs in wide variety and profusion, offered nothing conclusive. The same germs occur in abundance in healthy people. Yet work with nasal washings of apes and human beings indicated a virus caused colds.

In 1931 the periodic editorial remarked that colds caused more temporary disability than any other disease. If those afflicted would go to bed for three days all would be well but less than one-half a per cent. of the rascals did that. Promoters were about then leading the credulous to believe that vitamin D or surely vitamin A would rout their colds, a form of the higher rascality the doctor's journal politely deplored.

The learned medical writer finally remarked:

> "An old English general practitioner, when asked what was the best thing to get for a cold, replied 'Two dozen soft linen handkerchiefs.' The tendency of the common cold is to be self-

limited. At the end of three days the patient is generally better or beginning to get a more serious disease. The simple home remedies established by use in the last century will continue to be employed with considerable satisfaction by most people. They involve going to bed, indulging in perspiration by the use of hot water bottles and warm drinks slightly alkaline, the prescription of remedies somewhat antipyretic and analgesic (i. e., to reduce fever and lull pain), and watchful waiting for the onset of symptoms indicating any complication."

There you have it. That's about all the doctors know. If you get a cold, rush home and go to bed and take the traditional home remedies. You'll probably get better in three days. If not, you'll get worse. If complications appear during the watchful waiting period call a doctor. But he may not know whence came the cold nor whither it goeth.

It is generally supposed that a filtrable virus prepares the way, then a germ takes hold, then a cold starts. But the germs already roosting in affected nasal and throat tissues may flare up and produce a cold without waiting for the virus. They just remain dormant until some situation renders them impatient, then they rear up saying: "Boys, let's make a whale of a cold for this guy!"

Some doctors hold there are false colds and true colds, the latter being more severe and setting up an immunity that may last six months or a year. Such colds supposedly represent the presence in the body of something that flares up whenever resistance drops. But sometimes this itself increases resistance, the cold goes back to dormancy over night, and you write the one-night cold cure a fine testimonial.

Mere changes in the temperature of tissues may produce "false" colds which will recur every time the change occurs. Those suffering from frequent false colds possibly have sinus infection. Any considerable deviation from normal temperature impairs the germ-killing power of the blood and tissues. It upsets the body's defense mechanism against the bacteria it harbors. Hence the old mustard footbath was a sound means of counteracting chill and stirring up circulation.

Chilling also disturbs surface blood circulation. Germs lurking in the tissues arise and shout. Nasal swellings and discharges fol-

low. But these are less pronounced than in true colds and the false cold often clears up spontaneously and rapidly. But normal people "catch" colds only when colds are brought to them, not via chills and drafts. Finally, germs can always transmute, it seems, turning into other germs or strains of the same germ that are a lot more virulent.

We turn now to curing the cold. Work done at Johns Hopkins and published in 1931 showed that the use of ultraviolet rays from mercury-vapor lamps apparently increased, and certainly did not decrease, the incidence of severe colds. It showed that severe colds were just as frequent among those irradiated as among those not irradiated.

Work published from Western Reserve in 1934 showed that vitamin A in halibut-liver oil had no favorable or unfavorable effect on either the incidence or severity of colds. Some suggestive but not at all conclusive evidence indicated that this vitamin might possibly shorten colds slightly in winter.

As long ago as October 28, 1933, the Journal of the American Medical Association editorially denounced the tendency then manifest to add vitamin A (or its precursors) to cough drops or milk in order to make them cold preventives or cold cures. There was no proof that vitamin A was anti-infective. "There is no scientific basis on which any claim can be made for the rationality of including vitamin A in a cough syrup."

The journal went on: "The chief value of a cough drop is to keep one's mouth shut—and to yield a demulcent effect," i. e., to soothe. "For this purpose there are hosts of preparations on the market, sold without the hocus pocus and propaganda now connected with the so-called anti-infective vitamin."

It should also be remembered that cow's milk contains only one-tenth as much vitamin A in winter as in summer. Also that an eight-ounce glass of milk from stall-fed cows would contain about seventy units of this vitamin as compared with our daily adult requirement of 1500 units. Besides vitamin A has been proven neither to cure nor prevent colds.

It is almost second nature to gargle, yet the sport has no utility other than the pleasure to be derived from it. Gargling is useless no matter how good the gargle or how skilled the gargler, and most gargles are no good. Violent, gentle, head-tilting—no matter what

the technique, the liquid used cannot reach the points it should reach to be effective.

Of course a throat specialist can reach these spots. He can make quite a good stab at getting your throat and nasal passages germ free, for a very short while. Quite soon things will be as they were. What the specialist does is called "gravity irrigation," in case you would like to invest in some.

Then how about nose drops? It has become second nature also for Americans to shove various liquids up their noses to prevent or cure colds. As long ago as 1927 investigators at Johns Hopkins showed that this procedure when used on rabbits not only failed to relieve their sniffles, but rendered them liable to worse and often fatal infections. All the common household antiseptics were used in this work.

Specialists hold that human beings are like rabbits in this particular. Nasal drops tend to prepare the mucous membranes there to receive virulent germs. Remember always that those free from colds and those susceptible to or afflicted with colds have just about the same bacteria in the nasopharyngeal region anyway.

The United States Food and Drug Administration, enforcing the Food and Drugs Act, has long been seizing and condemning nose drops containing essential oils, methyl salicylate, ephedrine and so on, if recommended for the treatment of the nose and throat and to relieve rhinitis, catarrh and hoarseness. The admonition is just tilt your head back, insert a few drops, and bye-bye cold.

But the drug law enforcers say that is all hokum. In fact some of the nose drops are not even germicidal or antiseptic. The New York Board of Health in 1937 warned against the use of nasal oils in children's colds. Infants frequently inhaled the oil and developed pneumonia. Various doctors asserted that the use of such oils constituted a health menace.

What about vaccines? In 1936 a team of British cold experts named Thomson and Thompson reported that vaccines taken orally would prevent colds. But more careful tests of vaccines made by H. S. Diehl (one of the leading American researchers on the subject of colds) and his associates indicated they had no positive effect. There was no evidence that vaccines reduced the complications of colds or even that the condition of the nose and throat differed in cold-susceptibles from what it was in the cold-resistant individuals.

This brings us to proprietary cold cures. The simplest thing to say about cold cures is: There "aint" no such thing. Such cures have abounded for many years. They have been exposed as frauds by doctors and medical journals and their makers fined by the Government after action under the Food and Drugs Act, but still they abound.

A famous cure of recent years is a 60 per cent. alcohol solution of menthol and lavender, about equal in value to the old menthol stick, but selling for much more. Its claims have been declared false and misleading. Aspirin of various brands, perfectly pure chemically, has been seized and the makers fined because the label claim was made that the substance aided the treatment of grippe and influenza. Actually it has no value for colds specifically though it is a fairly safe pain easer.

Certain salves on a lard or petroleum base, containing oils of mustard and camphor have some value as counter irritants. Their fumes will also temporarily open the nasal passages. But they are not true cold cures in any sense of the word.

Various so-called laxative bromoquinine preparations in tablet form have also felt action by the Government for the label claim that they go right to the seat of the trouble, are cold remedies, or are the standard grippe and cold tablet of the world. Not only has the Food and Drug Administration acted but the Federal Trade Commission forbids makers of such preparations to say: "Stop that cold in its tracks . . . Kill colds dead . . . Strike at the cold itself, not merely at the symptoms."

There is no one-night cold cure, though colds occasionally abort spontaneously overnight. The tablets just mentioned are not germicidal and cannot cure colds. Finally the makers of general tonics have been forbidden to advertise that their product remedies or builds up resistance to colds, and the makers of cough drops and syrups to say that their products are effective in cold treatment because of vitamin A content.

Various physicians and medical research workers have from time to time thought they had found the way to prevent or cure colds. Early in January, 1928, Dr. Volney S. Cheney was quite sure that his system of administering sodium bicarbonate was the answer to the problem—just induce alkalinization at the first sign of throat dryness heralding a cold, and, farewell sniffles. But drinking

two ounces of bicarbonate in a large glass of water every two hours for three doses is rather heroic procedure itself.

Little is heard now about colds being caused by a mild acidosis. In fact most nutrition and medical experts would deny that we are prone to acidosis of dietetic origin. They would say there was no acidosis of that sort at all.

A throat specialist in 1932 suggested the use of aconite, sodium salicylate, aspirin, an inhalant for which he gave the formula, vaccine therapy, an antiseptic spray for which he also gave the formula—not to mention a hot bath, sodium bicarbonate, rest in bed, and purgation with calomel followed by salts, to abort and to cure colds. An injunction against violent nose blowing seems today almost the only sensible thing in his paper.

It was in 1933 that the aforementioned Dr. Harold S. Diehl announced that medication with certain codeine preparations was definitely effective in about three-quarters of all colds. He treated over a thousand cases of acute coryza as well as quite a number of chronic colds, influenza and pharyngitis. He found sodium bicarbonate and acetylsalicylic acid (aspirin) no more useful than lactose (milk sugar) tablets in treating colds. That is to say "definite improvement" followed in 35 to 42 per cent. of the cases treated!

Up jumps the woodpile Ethiopian. For we human beings are so suggestible that we imagine almost anything will help us if it is just recommended to us enthusiastically. That may explain why so many men and women marry. In any case Dr. Diehl's remedies —papaverine combined with dilaudid and with morphine—are rather drastic and should be restricted to physicians' prescriptions.

What may we say in conclusion? Something about like this:

Vitamins and purgation are no longer regarded as sound treatments for colds or influenza. Purgation simply weakens the body when it should be strong to fight off an infection, and it cannot render the gastrointestinal tract germ free anyway.

Alkalinization still has some devotees but the consensus of medical opinion has turned against it. It has been much overexploited especially in patent medicine advertisements.

Vaccines seem sometimes to work but certainly not with the high efficacy we have a right to expect of a real cure for a disease.

The line of demarcation between colds and influenza remains blurred. There is no specific for either, but rest in bed is wise whenever fever appears.

Aspirin is a good painkiller and sedative but has no fundamental effect whatever on the progress of the disease. It does ease the throat soreness to some extent when gargled, particularly if the tonsils have been removed and certain nerve ends are near the surface and easily reached.

The disease when treated by various disciplines, including that of taking a quart of whiskey to bed and going on a bender, seems quietly or stormily to run its own course as it wishes. Diehl's codeine and papaverine treatments still have their advocates.

If you must have a discipline Drs. Oscar W. Bethea and J. R. Godfrey advised in March, 1938: Go to bed. See no company. Take the diet the doctor orders, or what you can get if he doesn't. Take a little sodium bicarbonate and sodium citrate mixed every two hours. Take an aspirin occasionally if very uncomfortable. The doctor may give codeine sulfate if there is great discomfort. He will also paint your throat with silver nitrate if needed.

That seems to work about as well as any regimen in the avoidance of complications and in minimizing the dangers and ills of colds.

And we still do not know what causes colds.

HYDROGEN ION CONCENTRATION AND CYANOGENESIS IN SORGHUM

By James F. Couch and Reinhold R. Briese

Contribution from the Pathological Division, Bureau of Animal Industry, Washington, D. C.

(Continued from February Issue)

It therefore appeared legitimate to consider the average pH as the representative figure in the experiments that follow.

Johnson Grass (Sorghum halepense)

The specimen of Johnson grass used in these experiments was obtained from Woodward, Okla. It consisted of second cutting hay. The moisture content was 14.26 per cent. This specimen is now known to have been quite deficient in enzyme. On treatment with mercuric chloride and addition of enzyme the plant gave 313 mg. per cent. of HCN after a forty-eight-hour maceration at 37 degrees whereas with water alone the HCN yield was 222 mg. per cent. after the same period of maceration and 205 after twenty-four hours' maceration. All of the acids added during the experiments gave slightly higher yields after twenty-four hours' maceration, the highest, 213 mg. per cent., being obtained with 0.02 per cent. hydrochloric acid.

The data are presented in Tables 3 to 8. In Table 4 are presented the data obtained with hydrochloric acid. Addition of a small quantity of this acid stimulated cyanogenesis, the maximum quantity of HCN being recovered from the mixture to which 0.2 g. of HCl per liter had been added. The pH of the added acid solution in this

TABLE 3.—Optimum range of pH for dried Johnson grass with different acids.

Acid	pH range	HCN mg%
Hydrochloric	5.01 to 5.08	211 to 213
Sulfuric	4.90 to 5.10	205 to 206
Acetic	5.10 to 5.24	203 to 209
Oxalic	5.10 to 5.13	204 to 208
Tartaric	5.12 to 5.26	204 to 212

instance was 2.28 and of the mixture 5.23 indicating a marked buffer action by the constituents of the plant. This buffering is also shown with all other strengths of acid and with all the acids used.

Similar effects were observed with all acids used. When the acid solutions were incubated at 37 degrees for twenty-four hours the pH of the mixture was observed to change. With low concentrations and up to the range of optimum pH the solution becomes somewhat more acid on incubation whereas with stronger acid the effect is reversed and the solution becomes more alkaline, the degree of alkalinity being roughly proportional to the concentration of the added acid. This effect has been consistently noted throughout this study. It suggests that the reactions taking place in the different media are qualitatively different; that in the more dilute acids side fermentations with production of acids are taking place and that with more concentrated acids these fermentations are repressed and that ammonia or other organic bases are formed. Hydrolysis of HCN to ammonium formate cannot be assumed to explain these effects because formic acid is a strong acid and the effect would manifest itself in the opposite sense if ammonium formate were formed. In addition it has never been possible to detect formic acid in such mixtures. It is possible

TABLE 4.—Hydrocyanic acid produced by dried Johnson grass in hydrochloric acid at different pH. Weight of plant samples, 10 g. Volume of acid added, 120 cc.

Concn. of acid	pH					HCN, calcd. to plant used
g/liter	Acid sol.	Start	After 24 hours	Change	Average	mg%
0.1	2.56	5.41	4.63	—0.78	5.52	196
0.2	2.28	5.23	4.94	—0.29	5.08	213
0.3	2.12	5.01	5.02	0.01	5.01	211
0.4	2.01	4.78	4.90	0.12	4.84	197
0.5	1.91	4.62	4.73	0.11	4.67	188
0.6	1.84	4.49	4.58	0.09	4.53	174
0.8	1.73	4.08	4.33	0.25	4.21	141
1.0	1.67	3.94	4.13	0.19	4.03	109

that the nitrile group in the glucoside is hydrolyzed to ammonia and the corresponding acid, dhurrinic acid, which may be so weak that the resulting mixture will be more alkaline. It is not impossible that certain protein constituents of the plants may be broken up during the incubation to form basic products that contribute to the alkaline shift.

The effects of the different acids on the pH of their mixtures with the plants follow closely the dissociation constants of the acids. The addition of 0.5 g. of hydrochloric acid per liter produced the same pH effects as did 0.7 g. per liter of sulfuric acid: yet the latter produced about 5 per cent. less HCN. Indeed, sulfuric, acetic, and oxalic acids produced less HCN from Johnson grass than did hydrochloric or tartaric acids, the differences though small being uniform and well outside experimental error. The optimum ranges for the various acids, however, are quite uniform, as shown in Table 3.

On the whole the major effects of the various acids are proportional to the average hydrogen ion concentrations of the mixtures and little effect can be traced to the character of the anion. The plants are so well buffered that there is only a small change in the average pH until concentrations of acid in the neighborhood of 0.1 are employed. The quantity of HCN produced diminishes as the acid concentration increases. This effect is small in the neighborhood of the optimum pH but becomes very large with concentrations of 0.1 per cent. and

TABLE 5.—Hydrocyanic acid produced by dried Johnson grass in sulfuric acid at different pH. Weight of plant samples, 10 g. Volume of acid added, 120 cc.

Concn. of acid	pH					HCN, calcd. to plant used
g/liter	Acid sol.	Start	After 24 hours	Change	Average	mg%
0.1	2.75	5.44	4.79	—0.65	5.11	197
0.2	2.47	5.33	4.87	—0.46	5.10	206
0.3	2.30	5.02	4.76	—0.26	4.90	205
0.4	2.19	5.01	4.95	—0.06	4.98	196
0.5	2.10	4.87	4.89	0.02	4.88	193
0.7	1.98	4.59	4.73	0.14	4.66	178
1.0	1.84	4.30	4.46	0.16	4.38	162

upwards. Such a concentration of hydrochloric acid represses cyanogenesis nearly 50 per cent.; with sulfuric and oxalic acids the repression amounts to 20 per cent., while with acetic and tartaric acids the repression is less than 10 per cent. However, the concentrations of these acids in the optimum range do not differ greatly for the different acids: hydrochloric and sulfuric reach the optimum at 0.2 to 0.3 g. per liter, acetic and tartaric at 0.2 to 0.5 g. per liter, and oxalic at 0.3 to 0.4. These figures suggest that the mineral acids especially and the organic acids possibly are neutralized by the plant salts and that the free acids present are actually the same in all cases, being the natural

TABLE 6.—Hydrocyanic acid produced by dried Johnson grass in acetic acid at different pH. Weight of plant samples, 10 g. Volume of acid added, 120 cc.

Concn. of acid	pH					HCN, calcd. to plant used
g/liter	Acid sol.	Start	After 24 hours	Change	Average	mg%
0.1	3.75	5.55	4.73	—0.82	5.41	196
0.2		5.38	4.90	—0.48	5.24	204
0.3	3.51	5.31	4.99	—0.32	5.15	209
0.4		5.20	5.01	—0.19	5.10	206
0.5	3.39	5.15	5.06	—0.09	5.10	203
0.7	3.33	4.93	4.94	—0.01	4.93	199
1.0	3.22	4.80	4.89	0.09	4.84	193
2.	3.07	4.55	4.56	0.01	4.55	168
5.	2.87	4.07	4.20	0.13	4.14	118
10.	2.7	3.89	3.91	0.02	3.90	76
25.		3.49	3.55	0.06	3.52	45
50.		3.23	3.30	0.07	3.27	23
75.		3.09	3.13	0.04	3.11	17
100.	1.9	3.01	3.10	0.09	3.06	14
125.		2.84	2.93	0.09	2.89	11
150.		2.79	2.82	0.03	2.81	6

TABLE 7.—Hydrocyanic acid produced by dried Johnson grass in oxalic acid at different pH. Weight of plant sample, 10 g. Volume of acid added, 120 cc.

Concn. of acid (1)	pH					HCN, calcd. to plant used
g/liter	Acid sol.	Start	After 24 hours	Change	Average	mg%
0.05	3.32	5.58	4.80	—0.78	5.39	189
0.1	3.06	5.56	4.87	—0.67	5.34	192
0.2	2.77	5.44	4.91	—0.53	5.17	197
0.3	2.62	5.32	4.95	—0.37	5.13	208
0.4	2.51	5.25	4.96	—0.29	5.10	204
0.5	2.42	5.13	4.96	—0.17	5.04	199
0.7	2.29	4.90	4.87	—0.03	4.89	193
1.0	2.13	4.59	4.62	0.03	4.61	164
3.0	1.74	3.51	3.67	0.16	3.59	48
6.0	1.49	2.65	2.74	0.09	2.69	19

(1) Crystallized oxalic acid.

TABLE 8.—Hydrocyanic acid produced by dried Johnson grass in tartaric acid at different pH. Weight of plant samples, 10 g. Volume of acid added, 120 cc.

Concn. of acid	pH					HCN, calcd. to plant used
g/liter	Acid sol.	Start	After 24 hours	Change	Average	mg%
0.1	3.29	5.51	4.89	—0.62	5.31	200
0.2	3.08	5.45	4.92	—0.53	5.26	204
0.3	2.98	5.31	4.96	—0.35	5.14	212
0.4	2.96	5.21	4.98	—0.23	5.12	210
0.5	2.83	5.16	5.10	—0.06	5.13	209
0.7	2.73	5.00	4.93	—0.07	4.96	199
1.0	2.65	4.67	4.86	0.19	4.77	195
3.0	2.37	3.82	4.03	0.21	3.92	94
6.0	2.20	3.37	3.51	0.14	3.44	35.2

acids of the plant itself. The acids in sorghum juice have been shown by Willaman and his co-workers (43) to consist of malic, citric, tartaric, aconitic, and oxalic. Were this strictly true, however, there should be no differences noted between the various strong acids, the pH of the equivalent mixtures should be similar and the degree of cyanogenesis as measured by the HCN production should be the same. This question cannot be settled by the available data. Its solution must await more information concerning the very complex mixture present in these plants.

Hegari (a Variety of Sorghum vulgare)

Seven specimens of hegari were used in these experiments. They were grown at Arlington farm in the same plots as the Spur feterita and were handled similarly. The June specimens were grown in a different part of the field from the other collections and were planted four weeks earlier. The daily temperatures during the growing period were lower for the June plants but the water supply was the same in all cases, the water table being so near the surface of the soil that an adequate quantity was available at all times. The pertinent data are presented in Table 9. The HCN content is that determined by the

TABLE 9.—Hegari samples used in the following experiments:

Coll. No.	Date collected	Moisture	HCN content		Average height of plant	pH	
			Fresh	Dry		Start	After 24 hours
	1937	%	mg%	mg%			
22–37	June 22	85.42	15.8	108.	18 in.	5.50	4.84
25–37	June 24	80.18	13.3	67.1	20–22 in.	5.51	4.20
30–37	June 29	79.63	9.6	47.1	30–36 in.	5.55	4.16
60–37	July 27	80.40	47.6	238.	20–22 in. (1)		
89–37	Sept. 8	74.45	37.6	147.	5–6 ft. (2)	5.58	4.14
	1938						
62–38	Aug. 4	81.55	29.5	159.	36 in.	5.86	4.19
65–38	Aug. 9	80.73	27.3	142.	36 in.	5.70	4.18

(1) Used for hourly pH determinations.
(2) In soft-dough stage, heads and stalks discarded.

mercuric chloride process (14) except for No. 25-37, and is higher than that given in the tables that follow. In the latter case the cyanogenesis was interrupted at the twenty-fourth hour by the addition of hot water and mercuric chloride. The leaves only were used, the stalks and heads where present being discarded, and in the younger plants where a definite stalk had not been formed the lower six to eight inches of the plant was cut off and discarded. Data for the pH of these samples are based on 100 g. of minced plant in distilled water.

The same general tendencies are observed with hegari as with Spur feterita, Tables 11 to 14, inclusive. The buffering action is

TABLE 10.—Optimum pH range for hegari with different acids.

Coll. No.	Acid	pH range	HCN mg%
30–37	HCl	3.97–4.85	6.6– 7.0
89–37	HCl	3.89–4.86	30.0–30.9
22–37	H_2SO_4	4.14–4.87	12.2–12.9
25–37	Tartaric	4.49–4.85	10.3–10.9

TABLE 11.—Hydrocyanic acid produced by fresh hegari leaves in hydrochloric acid at different pH. Weight of plant samples, 100 g. Volume of acid added, 325 cc. Plant sample 30–37.

Concn. of acid	pH				HCN, calcd. to fresh plant
g/liter	Start	After 24 hours	Change	Average	mg%
0.	5.55	4.16	—1.39	4.85	6.6
0.1	5.04	4.11	—0.93	4.57	6.7
0.2	4.67	4.00	—0.67	4.33	6.7
0.3	4.19	3.87	—0.32	4.03	7.0
0.4	4.02	3.92	—0.10	3.97	6.6
0.5	3.91	3.90	—0.01	3.90	6.3
0.7	3.43	3.29	—0.14	3.36	5.8
1.0	3.14	3.09	—0.05	3.11	4.4

somewhat weaker with all three acids. The shift towards the alkaline side with the higher concentrations of acids is similar to that observed with Spur feterita and not so pronounced as with Johnson grass. The effective concentrations of the acids are somewhat higher than with Spur feterita, the optimum HCN yield being reached with concentrations of 0 to 0.4 and 0 to 0.3 g./liter of hydrochloric, 0.3 to 0.4 g./liter of sulfuric, and 0.1 to 0.4 g./liter of tartaric acid. A concentration of 0.1 per cent. acid decreased the HCN yield 37 and 11 per cent. with hydrochloric and 30 and 34 per cent. with sulfuric and tartaric acids, respectively. These figures are larger than the corresponding values for Spur feterita especially with sulfuric and tartaric acids and suggest that this variety is more sensitive to acids.

The optimum pH ranges as found are presented in Table 10. These are somewhat lower and less uniform than were observed with Johnson grass but do not differ significantly from the figures found with Spur feterita.

Differences between young and older plants are illustrated by the experiments with numbers 30-37 collected June 29, and 89-37 collected September 8, 1937, ten weeks later. The difference in age was

TABLE 12.—Hydrocyanic acid produced by fresh hegari leaves in hydrochloric acid at different pH. Weight of plant samples, 100 g. Volume of acid added, 300 cc. Plant sample 89–37.

Concn. of acid	pH				HCN, calcd. to fresh plant
g/liter	Start	After 24 hours	Change	Aver-age	mg%
0.	5.58	4.14	—1.44	4.86	29.9
0.1	5.03	4.13	—0.90	4.58	29.9
0.2	4.53	4.14	—0.49	4.34	30.0
0.3	4.17	4.10	—0.07	4.14	30.3
0.4	3.69	4.08	0.39	3.89	30.9
0.5	3.64	4.14	0.50	3.89	30.0
0.7	3.15	3.97	0.82	3.56	29.1
1.0	2.79	3.41	0.62	3.10	27.5

TABLE 13.—Hydrocyanic acid produced by fresh hegari leaves in sulfuric acid at different pH. Weight of plant samples, 100 g. Volume of acid added, 325 cc. Plant sample 22–37.

Concn. of acid	pH				HCN, calcd. to fresh plant
g/liter	Start	After 24 hours	Change	Average	mg%
0.	5.50	4.84	—0.66	5.17	11.6
0.1	5.07	4.96	—0.11	5.01	11.7
0.2	4.89	4.86	—0.03	4.87	12.1
0.3	4.64	4.79	0.15	4.71	12.9
0.4	4.44	4.33	—0.11	4.38	12.7
0.5	4.13	4.16	0.03	4.14	12.2
0.7	3.31	3.88	0.57	3.54	10.8
1.0	2.89	3.52	0.63	3.21	8.6

TABLE 14.—Hydrocyanic acid produced by fresh hegari leaves in tartaric acid at different pH. Weight of plant samples, 100 g. Volume of acid added, 325 cc. Plant sample 25–37.

Concn. of acid	pH				HCN, calcd. to fresh plant
g/liter	Start	After 24 hours	Change	Average	mg%
0.	5.51	4.20	—1.31	4.85	10.3
0.1	5.32	4.22	—1.10	4.76	10.8
0.2	5.17	4.17	—1.00	4.67	10.9
0.3	4.99	4.13	—0.86	4.56	10.8
0.4	4.92	4.17	—0.75	4.54	10.8
0.5	4.81	4.17	—0.64	4.49	10.3
0.7	4.57	4.22	—0.35	4.39	9.9
1.0	4.32	4.23	—0.09	4.27	7.8
3.0	3.54	3.72	0.18	3.63	7.2

six weeks. The variations observed follow closely those observed with Spur feterita under similar circumstances. The older plant contains a higher proportion of dry matter but has a weaker buffering action especially with the higher concentrations of acid. Little effect of the acid on cyanogenesis in the older plant is noticeable until a concentration of 0.07 per cent. acid is reached and at 0.1 per cent. there is a decrease of 11 per cent. in the HCN yield as against 37 per cent. in the younger plant at the same concentration. A more pronounced drift towards alkalinity is observed with the older plant which may be correlated with a lower proportion of fermentable sugars in the older leaves.

Spur feterita (a Variety of Sorghum vulgare)

Four specimens of Spur feterita were used in these experiments. They were grown at the Bureau of Plant Industry Experiment Station at Arlington, Va., and were collected early in the morning. The plants were minced and immersed in the acid solutions within an hour of collection so that changes due to drying were reduced to a minimum. The June and July specimens were grown in a different part of the field and were planted four weeks earlier than the September specimen. The daily temperature and water supply conditions were similar to those for the hegari specimens. The pertinent data for these specimens are presented in Table 15.

TABLE 15.—Spur feterita samples used in the following experiments:

Coll. No.	Date collected	Moisture	HCN content		Average height of plant	pH	
			Fresh	Dry		Start	After 24 hours
	1937	%	mg%	mg%			
13–37	June 16	85.8	11.6	81.6	16–18 in.	5.51	4.06
34–37	July 6	82.23	17.	95.6	24–30 in.	5.66	4.42
47–37	July 8	78.46	11.1	51.9	24–30 in.	5.58	4.26
50–37	July 13	76.27	11.2	47.3	30–36 in.	5.57	4.22
80–37	Sept. 1	72.19	26.7	96.	6–7 ft. (1)	5.52	4.13

(1) In soft-dough stage; heads and stalks discarded.

(*To be Continued*)

REPRINTED ARTICLE

SOME ASPECTS OF FIFTY YEARS' PROGRESS IN PHARMACEUTICAL AND RELATED SCIENCES

A part of the Presidential Address delivered before the Section on Pharmaceutical Science of the Australian and New Zealand Association for the Advancement of Science by E. M. Watson, and taken from the Australasian Journal of Pharmacy 20, 19 (1939):

The period has actually been one of great progress. The discovery of argon in 1894 by Ramsay, was followed rapidly by the unveiling of the whole family of elements, helium, neon, argon, krypton, xenon and, most recently, radon. A great achievement in itself, its consequences in theoretical chemistry have been still greater since these elements have provided essential links in the development of modern theories of atomic structure. Almost simultaneous with the discovery of argon was the recognition of X-rays by Röntgen. These rays, on account of their power of penetration, have proved of great utilitarian value to man, their application to diagnostic medicine resulting in the addition of substances such as barium sulphate and iodophthalein to the Pharmacopœia.

These discoveries were followed by the observation of radioactivity in 1896 by Becquerel, completing the trio of independent and apparently unrelated discoveries which proved to be prime factors in the solution of the problem of the nature of matter and electricity.

The use of radioactive substances in the treatment of cancer is familiar to all. Radium itself, isolated by the Curies in 1898, was first used in this way. Its activity, from a therapeutic point of view, is sensibly constant, since its period of half-life is about 1800 years. Radium has been replaced in therapy by its gaseous emanation, radon, the last member of the helium family. Weight for weight, radon has about 100,000 times the activity of radium. The period of half-life of radon is only 3.8 days, so that its activity is reduced to about one-quarter at the end of a week, or to about 1/256 in a month. This is no disadvantage, since the risk of overexposure is reduced.

The artificial production of light radioactive elements has opened a new field of radiotherapy. Appropriately enough, the phenomenon

of artificial radioactivity was discovered by M. and Mme. Curie-Joliot, son-in-law and daughter of Marie Curie, the discoverer of radium. These two workers showed, in 1934, that the liberation of positive electrons (positrons) which accompanied the bombardment of boron or aluminium with α-particles, did not cease when the bombardment stopped, but continued, diminishing in intensity in precisely the same way as a radioactive element of short life. In the short interval of four years, some 200 or more similar examples, some of which are of considerable interest from our point of view, have been discovered.

In general, the production of these radioactive substances consists of the bombardment of elements or compounds with a stream of fast-moving particles such as α-particles, protons, neutrons or heavy hydrogen nuclei (deuterons). Some of the bombarded atoms are changed by the entrance of one of the particles into the atomic nucleus, so forming a new nucleus, which may then disintegrate with the emission of a different particle and the formation of an atom of another element. Such artificially produced radioactive elements are nearly all isotopes of the ordinary chemical elements, being identical with them in their chemical properties, and differing only in their atomic weights and in possessing radioactive properties.

Radio-sodium, which has received more publicity than any other, is a typical example. First produced in 1935 by the bombardment of sodium chloride with high speed deuterons, it has since been prepared from magnesium and aluminium. Chemically it is identical with ordinary sodium—perhaps its chloride might be termed uncommon common salt—whilst it differs from it in having atomic weight 24 and in showing radioactivity. Its formation from sodium and deuterons may be expressed by

$$\underset{11}{\overset{23}{\mathrm{Na}}} + \underset{1}{\overset{2}{\mathrm{H}}} \longrightarrow \underset{11}{\overset{24}{\mathrm{Na}}} + \underset{1}{\overset{1}{\mathrm{H}}}$$

indicating the liberation of a proton during the formation of the active sodium. The decomposition of the active element may be written—

$$\underset{11}{\overset{24}{\mathrm{Na}}} \longrightarrow \underset{12}{\overset{24}{\mathrm{Mg}}} + \beta\text{-particle},$$

showing its conversion into ordinary magnesium with the expulsion of an electron. Its period of half-change is 15.8 hours, so that at

the end of two days its activity is reduced to about one-eighth of its original value. The obvious advantages of the material are that it may be administered orally as its chloride, since this is chemically identical with common salt, and that there is no necessity for an operation to remove it at the end of the period required by the dosage. A disadvantage is that, owing to its short period of half-life, it must be prepared where it is required for use.

A second active element of considerable interest and value is phosphorus. Radiophosphorus may be prepared in a number of ways, one of which is the deuterium bombardment of ordinary phosphorus:

$$^{31}_{15}\mathrm{P} + {}^{2}_{1}\mathrm{H} \longrightarrow {}^{32}_{15}\mathrm{P} + {}^{1}_{1}\mathrm{H}$$

The active element decomposes to ordinary sulphur with the emission of an electron:

$$^{32}_{15}\mathrm{P} \longrightarrow {}^{32}_{16}\mathrm{S} + \beta\text{-particle},$$

its period of half-life being a little over fourteen days, a very convenient time. The mixing of the active with inactive phosphorus and the conversion of the mixture into sodium phosphate gives a product which is suitable for administration in the food of test animals. The fate of the phosphorus—whether excretion, deposition, transfer from one tissue to another, and so on—can then be followed by simply tracing the radioactive atoms.

In this way it has already been shown that the characteristic tissues of the body which contain phosphorus, for example, brain tissue, bones, teeth and muscle, are in a dynamic and not static state, and are continually losing phosphorus atoms, or groups containing such atoms, and taking up others which are, in their turn, similarly replaced. It is clear that the development of this technique will give answers to questions concerning the intake of phosphorus, the method of its distribution to the various tissues, the time of retention in the body, etc., not only in normal, but also in abnormal conditions of diet and disease.

Such methods are not restricted to phosphorus, but may be extended to the study of the metabolism of calcium, iron, copper and iodine, to name just a few of the important elements which have been prepared in radioactive form.

In addition to the value of the radioactive elements themselves, the radiations which accompany their formation are likely to be of some use in therapy. The particles which offer greatest possibilities are the neutrons, which produce, on passing through living matter, strong ionization over a short path through collision with hydrogen atoms. It has been reckoned that the intensity of this ionization is about 100 times that developed by a secondary electron produced by X-rays. Since the biological effects on individual cells depend more on ionization intensity than on the total number of ions, it is reasonable to expect that neutrons will be more effective than X-rays in producing the required ionization. Although sufficient results are not yet available to give a definite statement on the matter, there is some evidence that this is so. Thus, for a given ionization, neutrons appear to be about five times as effective as X-rays in destroying malignant cells.

It would require several such addresses as this to review, even in a very perfunctory manner, the advances which have been made in the related fields of physics and physical chemistry during this period. The outstanding advances in medicine which may be directly attributed to development in physics include the diagnostic and therapeutic uses of X-rays, the use of radioactive substances, electrotherapy and diathermy, and the use of ultraviolet light, not only in actinotherapy, but also in such branches of physical chemistry as spectrophotometric assay and drug analysis by ultraviolet fluorescence. Of these, X-rays and radioactive substances have been mentioned previously.

Electrotherapy in its simpler aspects has been employed since about the middle of last century. The use of direct current for carrying therapeutic ions into the tissues, however, dates from the beginning of the present century with the work of Leduc. The method, known as cataphoresis or iontophoresis, is now restricted mainly to the use of zinc and copper ions on account of their germicidal and cauterizing properties. Use is made of the so-called faradic current from the induction coil for the purpose of stimulating excitable tissues, particularly the motor nerves, which alternating currents have somewhat similar properties and have some therapeutic value in treatment of paralysis. Diathermy is simply a form of high frequency current treatment which results chiefly in the generation of heat in the path of the current. By appropriate modification, a

high frequency current may be produced which causes disruption of tissues, so that, using suitable electrodes, the tissues may be cut, the adjacent protoplasm coagulated and the lymphatics and small blood vessels sealed, so giving a condition of bloodless surgery.

The value of ultraviolet light in therapy has been set forth at length in various medical journals during the past few years, and, although some of the claims advanced for it cannot be upheld, there is substantial evidence available in support of its use in some conditions. The use of ultraviolet light fluorescence in drug identification and analysis has been developed largely through the work of Grant. In this field, papers were presented to this section by C. A. Taylor and J. G. Tibbett at the Sydney meeting in 1932. It is of interest to note the inclusion in the 1936 addendum of an ultraviolet fluorescence test for showing the presence of rhapontic rhubarb in the official drug.

The investigation of the relationship between visible and ultraviolet absorption and chemical structure was taken up a little earlier than 1880, and has been carried on over many years. No direct connection has been established between the structure of a compound and its absorption spectrum, so that it is not possible to state, other than by analogy, what kind of absorption a particular compound may produce. The methods which have been developed, however, are of considerable value for comparative purposes, as, for example, in the estimation of substances such as vitamin A. The spectrophotometric assay of these substances depends on the measurement of the extinction coefficients in a suitable solution at one or more selected wave lengths. The extinction coefficient is given by the formula

$$E = \log\frac{Io}{I} \,/\, dc$$

where Io = intensity of the incident light
I = intensity the emergent light
d = thickness of the solution through which the light has passed
and c = concentration of the solution.

In practice, d is always 1 cm. and c is 1 per cent., so that

$$E^{1\%}_{1\text{ cm.}} = \log\frac{Io}{I}$$

The spectrophotometric assay of vitamin A is included in the 1936 Addendum, as well as the biological assay, with the necessary proviso that, should there be any difference between the two results, that of the biological method shall prevail. The proviso is necessary, since a specimen under examination may be devoid of vitamin A activity and yet contain some substance which shows absorption at the selected wave length of 328 mμ.

Developments in physics which have led, for example, to the use of the oscillograph for visualization of the heart beat, the construction of the iron lung, the designing of Svedberg's ultra-centrifuge and its use in the investigation of proteins and other colloids, are too numerous and too highly specialized in most cases to warrant their discussion in an address of this nature.

Of the contributions which physical chemistry has made to medicine, some of the most important are developments from Arrhenius' ionic theory of solution. Van't Hoff's work on the correlation of the known laws of solution with osmotic pressure, which led to a purely physical theory of solution, was published in 1887, and gave Arrhenius an opportunity of expressing, in a definite way, ideas which he had held for some time and had developed in his inaugural dissertation in 1884. The actual existence of ions was familiar from Faraday's work on electrolysis, and their presence to some small extent in solution before the passage of an electric current had been recognized by Clausius. Arrhenius' suggestion that more or less complete dissociation occurred during the process of solution was, however, quite new.

The application of the law of mass action to such dissociation, although admittedly not justified in the case of strong electrolytes, has proved a very useful method of attack on many problems. Our ideas of the relative strengths of acids and bases, of titration and the use of indicators, and of salt hydrolysis, have emerged from such application, and have led, in our own particular field, to the development of satisfactory volumetric methods for the estimation of weak bases, such as the alkaloids and of weak acids. The importance of this in the standardization of drugs and galenicals of low alkaloid content has already been mentioned.

A further development from the application of mass action principles to electrolytic dissociation is the recognition of reserve acidity and reserve alkalinity. This phenomenon, known appropriately

enough as buffer action, is shown particularly by solutions of weak acids containing their salts with strong bases. In such solutions, reserve acidity, that is, the tendency of the solution to resist change in concentration of hydrogen ion on addition of alkali, is provided by the reaction

$$HA + OH^- \longrightarrow A^- + H_2O$$

whilst reserve alkalinity is conferred by the reaction

$$A^- + H^+ \longrightarrow HA.$$

Buffers are of considerable importance in the maintenance of the acidity or alkalinity of the body fluids. The buffer system of the blood and tissues, for example, is of threefold nature, including the carbonic acid-bicarbonate, the phosphate and the protein systems. The first two are the most efficient buffers, producing their effects through the reversible equilibria—

$$H_2O + CO_2 \leftrightarrows H_2CO_3 \leftrightarrows H^+ + HCO_3^-$$

and

$$H_2PO_4^- \leftrightarrows H^+ + HPO_4^{--}$$

Reserve alkalinity is given by the reactions

$$HCO_3^- + H^+ \longrightarrow H_2O + CO_2$$

and

$$HPO_4^{--} + H^+ \longrightarrow H_2PO_4^-$$

whilst reserve acidity is due to

$$H_2CO_3 + OH^- \longrightarrow HCO_3^- + H_2O$$

and

$$H_2PO_4^- + OH^- \longrightarrow HPO_4^{--} + H_2O$$

The protein salts react in a similar manner, but their effect is less pronounced.

The present method of expressing the hydrogen ion concentration of solutions in terms of pH originated in Nernst's thermodynamical work on the e.m.f. of simple electrical cells. The e.m.f. of a cell composed of two platinum electrodes, saturated with hydrogen, in solutions containing hydrogen ions at concentrations of c_1 and c_2, is given by

$$E = \frac{RT}{F} \log e \frac{c_1}{c_2}$$

where R is the gas constant (expressed in electrical units), T the absolute temperature, and F the charge on the univalent gram ion. If c_1 is unity, i. e., the first solution is of normal concentration with respect to hydrogen ions, the equation reduces to the form

$$E = E_o + \frac{RT}{F} \log e \frac{1}{c_2}$$

where E_0 is called the normal potential for the hydrogen electrode and is arbitrarily assumed to be zero at all temperatures for a hydrogen pressure of one atmosphere. The equation thus becomes, at, say, 18 degrees C.,

$$E = 0.057 \log \frac{1}{c_2}$$

In other words, the e.m.f. of the cell is directly proportionate to $\log \frac{1}{c_2}$, i. e., to the logarithm of the inverse of the hydrogen ion concentration in the second solution. $\text{Log} \frac{1}{c}$ thus gives a convenient method of expressing hydrogen ion concentration, and the figure has been termed the hydrogen ion exponent. It was formerly written $P_H +$ since it is a measure of the pressure (or concentration) of hydrogen ions in solution, a symbol which, for typographical reasons has been altered to pH. The determination of pH is most accurately made by electro-metric methods, but, partly owing to the cost of the necessary electrical equipment, colorimetric methods are commonly employed. A description of such colorimetric determination is included as an appendix to the 1932 B. P.

Before leaving this brief review of the contributions of physical chemistry to medicine and pharmacy, some reference should be made to the subject of colloids. Although the major discoveries relative to the study of colloids had been made prior to 1885, and Graham had drawn distinctions between crystalloids and colloids, yet for many years the colloidal state could be rightly described as a region of neglected dimensions.

The use of colloidal preparations in medicines, if we leave out that of finely emulsified mercury in ointments and the 1885 B. P. Liq. Ferri Dialysatus, began with the introduction of colloidal silver in the eighteen-nineties. Much of the early work was done by French investigators, but the recognition that the effect of the inorganic hydrosol is the same as that of the complex salts of the metal concerned was due chiefly to the work of the Italians, Ascoli, Izar, Filippi and Preti. This conclusion was justified by Paul, who showed that colloidal silver preparations, for example, always produce silver

ions in aqueous solution, generally in sufficient quantity to keep the blood serum saturated.

The order of toxicity of colloidal solution of metals, measured on protozoan organisms such as Paramœcium and Vorticella, is silver, mercury, copper, nickel, palladium and gold, an order which is strikingly paralleled by that of solutions of the salts of these metals. Although highly toxic to such protozoans and to bacteria, such preparations are practically without action on moulds and fungi. Similarly they destroy toxins such as those of tetanus, diphtheria and dysentary organisms, but are without action on enzymes such as pepsin, rennin, trypsin and pancreatic lipase.

The use of mixed colloids such as silver-mercury, gold-silver and silver-copper, is based on the supposition that by their localized accumulation they form small electric cells in which the more basic metal is more readily ionized, so effecting faster destruction of bacteria.

Many elements have been examined from the point of view of the value of their colloidal solutions (or those of their compounds) in therapy, the most important being copper, silver, gold, mercury, lead, phosphorus, arsenic, antimony, bismuth, sulphur, selenium, manganese, iron, nickel, palladium, platinum, calcium, aluminium and iodine. The oral administration of many colloidal preparations is of very doubtful value, since, even though accompanied by protective colloids, most negatively charged colloids will be coagulated by the acid gastric juice and the positively charged metal hydroxide sols will be converted into solutions of their chlorides. The value and fate of injected colloids is also problematical; unprotected colloids probably have short life in the blood stream, although both in this and in protected condition they exert considerable effect on the blood, both from the point of view of its colloidal structure and the number of corpuscles present. The protein content of the serum increases, as does also the ratio of albumins to globulins; initial haemolysis considerably diminishes the number of red cells, and leucocytes disappear simultaneously. Later there is rapid production of red cells, bringing the number back to or slightly above normal, whilst the leucocytes similarly return to normal numbers.

(To be Continued)

ABSTRACTS FROM AND REVIEWS OF THE LITERATURE OF THE SCIENCES SUPPORTING PUBLIC HEALTH

Bacteriology . . . . **Louis Gershenfeld, B. Sc., Ph M.**
Biology . . . . . **Marin S. Dunn, Ph. D.**
Chemistry . . . . . **Arthur Osol, Ph. D.**
Pharmacy . . . . . **E. Fullerton Cook, Ph. M.**
and their assistants

Preparation and Stability of Adrenalin Solutions. W. Luhr and H. G. Rietschel. *Pharm. Zentralh. 79,* 193 (1938), through *Quart. J. Pharm. & Pharmacol. 11,* 788 (1938). In order to obtain stable solutions of adrenalin it is necessary to exclude the influence of light and air, while the pH should not be higher than 2.9. In practice the solution is found to keep better if sealed in an atmosphere of carbon dioxide than in nitrogen. The solution should be prepared in artificial light, using redistilled water that has been cooled in an atmosphere of carbon dioxide. It is then filled into ampuls of colorless glass which allow any subsequent discoloration to be observed. By heating the ampuls in a water bath immediately before filling, complete displacement of air is obtained. The solution is finally sterilized at 120 degrees C. Ampuls prepared in this way and stored for three months in the dark showed no loss of strength when tested chemically and physiologically. Although sulfite has some preservative action on acid solutions of adrenalin, this is due to its reducing action and the addition is undesirable and unnecessary. Mannitol, which has been stated to have a preservative action, was found to be quite ineffective. Chlorbutanol, on the other hand, does help to preserve the solution in presence of air and may therefore be added with advantage. The formula recommended is as follows: adrenalin 0.1 gm.; sodium chloride 0.9 gm.; n/10 hydrochloric acid 6.5 cc.; chlorbutanol 0.5 gm.; redistilled water (air free) to make 100 cc. L. F. T.

Nasal Hygiene. *Clinical Medicine and Surgery 46,* 160 (1939). An editorial in this medical journal emanating from the

midwest comments on the lack of uniformity among physicians' opinions as to the value of the administration of nose drops.

Whereas most of the rhinologists of this country believe that oils in the nose are unwise, and adversely affect the mucosa, their opinions seem based on oils which are manufactured on a large scale and are available to all buyers on the open market, through extensive advertising, and containing large measures of menthol and other volatile substances of "irritating" nature.

Little or no results seem to be available on work done on bland oils alone, except the recommendation by a South African professor that a quantity of bland oil, by itself, be used in the nose daily as a simple routine in nasal hygiene.

More research is called for on this subject in which all seem to have reached conclusions without justification. J. E. K.

The Use of Magnesium Sulfate in the Measurement of Circulation Time. M. Bernstein and S. Simpkins. *The Amer. Heart J. 17,* 218 (1939). The use of magnesium as a circulation time agent has been suggested abroad by two authors. The present workers report on a technique which enables one to determine with ease the circulation time of the blood. The method is well adapted for bedside and office use. In brief the method consists in having the patient recline as nearly as possible flat in bed with the arm at the level of the right auricle. The patient is instructed to relax and not hold his breath as this retards the venous return to the heart. A tourniquet is applied to the arm and 6 cc. of a 10 per cent. solution of magnesium sulfate are injected intravenously. The injection is made as rapidly as possible and the time accurately taken with a stop watch. The end point is manifested by the patient reporting a sudden and intense feeling of warmth in the pharynx which follows progressively the course of the peripheral arterial beds, being felt next in the face, hands and finally the feet. The sensation is transient passing off within ten to twenty seconds and the test may be repeated within a few minutes with practically duplicate results. Although no magnesium idiosyncrasy has been observed, an ampul containing 10 per cent. calcium gluconate should be available for such a possible case.

Based on a comprehensive study of a large number of normal and cardiac patients the authors report the observed circulation time in both groups. A comparison is made of the calcium and ether circulation time methods with the magnesium and a number of important observations are made of interest to the physiologist and physician. L. F. T.

Anaesthetics. A year's progress in this field. *The Prescriber 33,* 116 (1939). Recent reports on anaesthetics are contained in this British article. Among the local anaesthetics, novocaine was reported as safe, non-irritating, easily used and non-habit forming. In the use of procaine, several untoward reactions were reported. Percaine was noted for surface anaesthesia.

Paraldehyde was considered the safest of all basal anaesthetics, while avertin, although an established basal narcotic, tends to decomposition at higher temperatures. The barbiturates used as true basal anaesthetics are Evipan Sodium, Pentothal Sodium, Medinal, Seconal, Sodium Amytal, Nembutal and Sodium Thioethamyl. Expert administration must be the rule when using this group.

Novocaine (procaine) and Percaine (nupercaine) were mentioned as the chief spinal anaesthetics. Evipan and sodium pentothal were favorably reported for spinal anaesthesia.

There have been a number of recent reports in the British medical press on ether convulsions. Nembutal-chloral narcosis in childbirth received favorable notice. Helium may be used in cases of respiratory obstruction. Despite some untoward incidents, cyclopropane has proved itself invaluable in thoracic surgery. The skin should be protected by a bland ointment before administration of vinyl ether as an anaesthetic. A combination of nitrous oxide and oxygen is being used extensively in dentistry, being safer in cardiac complications. J. E. K.

A Biochemical Diagnostic Test for Malaria. H. O. Proske and R. B. Watson. *Public Health Reports 54,* 158 (1939). In 1927 Henry described a serodiagnostic test for malaria. This test was based on the assumption that malaria pigment is an active substance which either gives rise to the production of antibodies or imparts flocculating peculiarities to the serum of malaria patients. Other investigators have since demonstrated that choroidal melanin

does not possess antigenic properties and that the melano-flocculation reaction of Henry is due to a disequilibrium of serum proteins brought about by an increase in serum euglobulin.

It is generally advocated that a photometer be used in connection with the reading of the Henry test and its principal modifications. The expense of this instrument may account for the fact that the Henry test has not been much used in this country.

The authors describe a new colorimetric test which is simple, accurate and not requiring a photometer. The procedure is based on the fact that proteins possess a chromogenic property which can be measured quantitatively against the color produced by pure tyrosin in the presence of a phenol reagent. This chromogenic value is constant for a given protein and the intensity of the color produced can be used as a measure of the amount of the protein examined. Serum euglobulin is precipitated from the serum to be examined by the addition of 13.5 per cent. sodium sulfate solution according to the method of Howe. The tyrosin chromogenic index (TI) is determined by comparison with standards prepared from pure tyrosin (Pfanstiehl). As a result of the examination of over 2000 normal blood serums the authors found that the tyrosin index for euglobulin fluctuates between 50 and 80, while that for serum from malaria patients ranges from 80-280, or higher. The test was found to be indicative of the presence of malaria in 97.4 per cent. of known malaria cases examined, as compared with 81.9 per cent. positive thick blood films examined at the same time.

Like the Henry test and its modifications the test is non-specific, but its high sensitivity in malaria may make it a useful adjunct in the laboratory diagnosis of the disease. It may also be helpful in the differential diagnosis of other pathologic conditions characterized by an increase in serum euglobulin. L. F. T.

Methyl Cellulose in Soap Making. P. I. Smith. *Amer. Perfumer 38,* 456 (1939). Methyl cellulose is receiving considerable attention as a filler for both hard and soft soaps and it is claimed that by its use the fatty acid content of soaps can be reduced 30 to 32 per cent.

This new form of cellulose is obtainable in commercial quantities as a felt-like fibrous dry mass which is supplied in compressed blocks of about one pound, two pounds, four and one-half pounds and

eleven pounds, as well as larger amounts amounting to as much as 200 pounds in compressed bales. In dry form methyl cellulose is not readily inflammable and its storage presents no difficulties of any kind. It is non-hygroscopic and it can only be taken into solution by mixing with boiling water.

When boiling water is poured over methyl cellulose it swells to a considerable extent and forms a highly viscous water white neutral solution. Solutions do not readily mold and they are not affected by ordinary chemicals including dilute acids and strong alkalies.

The viscous nature of even dilute solutions of this cellulose body seem to warrant its use in soap as a body contributing substance and it actually improves the lathering and emollient effect. A variation in the pH of the system does not affect its properties.

Several varieties of methyl cellulose are available differing in their solubility and viscosity. L. F. T.

Stilbestrol—A New Synthetic Possessing Sex Hormone Activity. Condensed from *Pharm. J. 88,* 31 (1939). Following the discovery and characterization of several substances of slightly varying constitution, all possessing estrogenic activity, Cook, Dodds and their co-workers began an investigation into the specificity of estrus action. A very large number of phenanthrene derivatives were examined and in 1933 a relatively simple substance was obtained which exhibited about one ten-thousandth part of the activity of the natural substance. Subsequently, it was demonstrated that the phenanthrene nucleus was not essential and activity was observed in a simple derivative of benzene, namely, p. hydroxypropenylbenzene. Intensive research with the object being the preparation of a simple chemical substance of high potency culminated in 1938 in the discovery that 4:4 dihydroxy α : β diethylstilbene possessed nearly three times the activity of the natural hormone and was, moreover, highly active when taken by mouth.

Until recently the evidence of the similarity in action of the synthetic substance and the natural hormones rested entirely upon animal experiments but the first reports of clinical trial are now available. The general conclusion appears to be that stilbestrol "imitates the natural estrogens faithfully and is highly active by mouth." L. F. T.

SOLID EXTRACTS

By Ivor Griffith, Ph. M., Sc. D.

Despite the form in which this information is presented it may be accepted as trustworthy and up-to-date. Original sources are not listed but they may be obtained upon request.

French tricksters with animal hybridization have recently developed a spectral color range with rabbits in such a way that they can at will produce a squirrel colored bunny as readily as they might a pale blue coney. In another direction American scientists have worked with chickens so that colored eggs might be produced. Whether Easter eggs *au naturelle* may so result is a sheer conjecture. But light blue eggs *are* being laid by hens of a new hybrid type, produced in the poultry department of Cornell University. The hens are a cross between the ordinary white legborn and a South American fowl known as the Araucana hen, which lays deep blue eggs. When crossed with fowl that normally lay brown-shelled eggs, a hybrid is produced that lays eggs with olive-colored shells.

Parents of precocious children should draw comfort from this survey. Child geniuses succeed, is the answer provided by Dr. Lewis M. Terman, Stanford University psychologist, in a follow-up of the greater part of a group of 1400 gifted children selected in 1922 as being the brightest among 250,000 California school children.

Half the boys entered the professions, law getting the largest number, and a fourth are in semi-professional occupations or business. The other fourth are scattered among such jobs as jazz band players, Walt Disney artists, ghost writers, radio announcers, movie technicians, salesmen, clerks, seamen, a rare stamp dealer, a policeman and a fox farmer.

Although the depression hit them hard, not one has been on relief rolls.

It is of interest to know that Philadelphia's atmosphere is not polluted nearly as badly as are the streams that supply its water.

Thus in figures indicating the parts of sulfur dioxide per million parts of air, five metropolitan areas rate as follows:

	Average
St. Louis-East St. Louis	.128
Pittsburgh	.057
Detroit	.028
Philadelphia-Camden	.027
Washington	.009

It is a comfort to know that the above figures have, however, no significance from a public health standpoint, according to hygienists connected with the investigation.

A bit of mathematics was sprinkled into the American breakfast coffee cup and the verdict is that it is not necessary to be too careful in stirring your coffee.

This is one of the far-reaching consequences of some new theorems presented to the American Mathematical Society by J. C. Oxtoby, one of Harvard's junior fellows who is researching in mathematics.

His paper concerned "metrically transitive" transformations. A single stir of a cup of coffee is one example of a transformation: it carries, or "transforms," each drop of coffee to some definite new position in the cup. Mr. Oxtoby's methods applied to this particular case show with mathematical certainty that if such a single stir, or transformation, is applied repeatedly, it is almost certain that every bit of coffee will ultimately be adjacent to some drop of cream, and so Time marches on!

Much of the toughness of beef and other meats is due to the collagen that binds the meat fibers together. By an age-old practice, skilled chefs hang their best beef for a long period of time until natural enzymes soften the collagen and the meat becomes tender. The best hotels and restaurants select their beef, then have it hung for weeks. It is an expensive process because of spoilage, weight

loss, storage costs, etc., and not available to the homeowner; and the appearance of hung beef is hardly suited to retail distribution.

Now comes the physicist with a new ray method of tenderizing meat. The use of papaya extracts has not been altogether satisfactory because of a livering of the meat, but the new electric method is said to be startlingly effective and the toughest old steer may have his meat so changed overnight that all his brisket turns to *filet-mignon!*

Four thousand years ago the Chinese had guessed that goiter was a disease related to diet—that it mostly attacked people who lived away from the sea—that it yielded sometimes to treatment with sea medicaments—salt of the sea—sponge from the sea—seaweeds and coral.

Later Dioscorides, a Greek physician, and author of a treatise on Materia Medica, recommends the use of sponge to "check tumors" —and if we assume that by tumors he meant goiters, we have to admit that he "knew his sponges." The Syriac Book of Medicines (200-300 A. D.) directs "burn a sponge in the fire, crush it in wine and administer as a draught."

BOOK REVIEWS

Done by persons, unafraid to upbraid, but perfectly willing to give praise where praise is really due.

Treatise on Pharmacy. By Charles Caspari, Jr., and E. F. Kelly. 8th edition. Pp. 553 incl. index. Lea & Febiger, Philadelphia, Pa.

The subject matter of this well known pharmaceutical text is divided into two parts. Part I entitled General Pharmacy includes the study of pharmaceutical standards, systems of measurements, the physical constants, forms of energy, etc. Part II is concerned with the study of the preparation, preservation and dispensing the various classes of medicinal preparations and with answering certain questions which might arise as to the official directions and tests.

Although a great deal of information is contained in this new edition the reviewer finds two major criticisms. First, a number of errors may be found in the official titles of certain preparations. Second, the book fails to treat in an adequate manner some of the newer phases of pharmaceutical practice such as the theory and applications of pH measurement, isotonic solutions, buffers and buffered solutions, the manufacture of sterile products and emulsions.

L. F. TICE

Marihuana, America's New Drug Problem. By Robert P. Walton, Professor of Pharmacology, University of Mississippi. 223 pages, 17 illustrations, graphs and 3 tables. Published by J. B. Lippincott, Philadelphia, Pa. Price $3.00. 1938.

To Marihuana (hashish or cannabis), the strangest powers have been attributed, such as the secret of the "Artificial Paradise" and of Jonathan's and Samson's strength.

The use of cannabis as a "dope" has spread with an unbelievable speed throughout the United States in the last five to ten years, especially among the morally weak and the irresponsible youth of the land. Therefore the subject commands the widest interest, as an universal evil, of every responsible citizen, and particularly the professional worker, official, teacher and parent.

Well arranged in eleven chapters are discussed the history, world distribution and present status of the cannabis vice, the plant source, varied forms of the "dope" use, excerpts from the literature, effects (acute and chronic and therapeutic) pharmaceutical preparations and chemical nature of the active principle; this is followed by an elaborate nomenclature and a list of 419 classified references.

While cannabis admittedly affects especially brain functions as sensation and emotion, detailed acute symptoms as anesthesia are of particular interest to the bio-assayist. Thus locomotory narcosis in dogs and mice has been used by other workers and daphnia magna by this reviewer in recording the strength of cannabis or its preparations.

Of pharmaceutical interest is that bromural is considered most effective in breaking the habit of cannabis. (Another drug perversion, the smoking of aspirin in cigarettes, is also recorded.) As known among officials, marihuana leads often to the heroin habit and likely to insanity.

While the chemical and physiological methods of identification are discussed in considerable detail, the botanical and histological characteristics for identification are far too briefly treated, in my opinion, to serve as a guide.

On the whole the book is a valuable, up-to-date document, representing first-hand information, years of collection and final critical selection of these data.

ARNO VIEHOEVER

Vitamins and Hormones, and Their Technical Preparation II. Preparation of Vitamin Substances. By Dr. Franz Seitz. 205 pages. Published in German by S. Hirzel, Leipzig, Cl. Price paper bound 7.00 Reichsmark.

In this second volume of the concise series "Chemistry and Technic of Our Time" (under the general editorship of Dr. Carlsohn), the author Dr. Seitz presents his subject of vitamins in six major divisions: (1) fat soluble (A, D, E, K); (2) water soluble (B_1, B_2, C, H); (3) vitamin medicaments; (4) vitamin foods; (5) vitamin cosmetics; (6) commercial vitamin preparations.

Dr. Seitz lists in his concise, up-to-date treatise the vitamins which have been prepared in pure state (A, B_1, B_2, C, D_1, D_2 and E),

the last four having now also been synthesized. In his critical interpretative survey he has consulted 720 patients; 130 German, 109 American, 111 English, 68 French, etc. Tabulations for sources of vitamins and detailed flow sheets for their preparations greatly facilitate quick orientation and provide useful directions.

Of great value are the detailed references to patients, the present and former designations as recommended by the vitamin workers for the pure vitamins and the standards adopted or proposed.

The physical, chemical and physiological properties are indicated for many substances, vitamins and vitamin-like. No reference is made to "Vitamin F" from linseed given so much prominence by distributors of commercial vitamin products.

Although the literature concerning vitamins has increased like an avalanche, practically no survey has thus far been printed of technical methods of preparations. Dr. Seitz's book will therefore be especially welcomed by chemical and pharmaceutical workers and teachers.

ARNO VIEHOEVER